

CLAIMS

1. A fiber or filament formed from ingredients comprising (a) at least one fiber-forming thermoplastic polymer, and (b) at least one polybrominated anionic styrenic polymer, wherein the polybrominated anionic styrenic polymer has a bromine content of at least about 50 wt%.
2. A fiber or filament according to Claim 1 wherein said fiber-forming thermoplastic polymer is a polyester.
3. A fiber or filament according to Claim 2 wherein said polyester is polyethylene terephthalate, polybutylene terephthalate, or polytrimethylene terephthalate.
4. A fiber or filament according to Claim 1 wherein said fiber-forming thermoplastic polymer is a polyamide.
5. A fiber or filament according to Claim 4 wherein said polyamide is nylon-6 (polycaprolactam), nylon-6,6, nylon-6,12, nylon-12 (polylauryllactam), or a high temperature nylon.
6. A fiber or filament according to Claim 1 wherein said fiber-forming thermoplastic polymer is a polyolefin.
7. A fiber or filament according to Claim 6 wherein said polyolefin is polypropylene.
8. A fiber or filament according to Claim 1 wherein said bromine content of said polybrominated anionic styrenic polymer is at least about 60 wt%.

9. A fiber or filament according to Claim 1 wherein said polybrominated anionic styrenic polymer is a brominated anionic polystyrene.

10. A fiber or filament according to Claim 2 wherein said bromine content of said polybrominated anionic styrenic polymer is at least about 60 wt%, wherein said polybrominated anionic styrenic polymer is a brominated anionic polystyrene, and wherein said polyester is polyethylene terephthalate, polybutylene terephthalate, or polytrimethylene terephthalate.

11. A fiber or filament according to Claim 2 wherein said bromine content of said polybrominated anionic styrenic polymer is at least about 67 wt%, wherein said polybrominated anionic styrenic polymer is a brominated anionic polystyrene, and wherein said polyester is polyethylene terephthalate, polybutylene terephthalate, or polytrimethylene terephthalate.

12. A fiber or filament according to Claim 4 wherein said bromine content of said polybrominated anionic styrenic polymer is at least about 60 wt%, wherein said polybrominated anionic styrenic polymer is a brominated anionic polystyrene, and wherein said polyamide is nylon-6 (polycaprolactam), nylon-6,6, nylon-6,12, nylon-12 (polylauryllactam), or a high temperature nylon.

13. A fiber or filament according to Claim 4 wherein said bromine content of said polybrominated anionic styrenic polymer is at least about 67 wt%, wherein said polybrominated anionic styrenic polymer is a brominated anionic polystyrene, and wherein said polyamide is nylon-6 (polycaprolactam), nylon-6,6, nylon-6,12, nylon-12 (polylauryllactam), or a high temperature nylon.

14. A fiber or filament according to Claim 6 wherein said bromine content of said polybrominated anionic styrenic polymer is at least about 60 wt%, wherein said

polybrominated anionic styrenic polymer is a brominated anionic polystyrene, and wherein said polyolefin is polypropylene.

15. A fiber or filament according to Claim 6 wherein said bromine content of said polybrominated anionic styrenic polymer is at least about 67 wt%, wherein said polybrominated anionic styrenic polymer is a brominated anionic polystyrene, and wherein said polyolefin is polypropylene.

16. A fiber or filament according to Claim 1 wherein the linear density of said fiber or filament is in the range of about 2 to about 25 denier.

17. A fiber or filament according to Claim 1 wherein said polybrominated anionic styrenic polymer is a brominated anionic polystyrene, and wherein the linear density of said fiber or filament is in the range of about 2 to about 25 denier.

18. A thread or yarn formed from a fiber or filament of Claim 1.

19. A blend of fibers or filaments wherein a fiber or filament of Claim 1 is a component of said blend.

20. A fiber or filament according to Claim 1 wherein said polybrominated anionic styrenic polymer has at least one of the following characteristics:

- (i) a thermal stability in the Thermal Stability Test of 200 ppm HBr or less;
- (ii) a chlorine content, if any, of less than about 700 ppm Cl;
- (iii) a TGA temperature for 1% weight loss which is 340°C or higher;
- (iv) a ΔE color value, measured using 10 wt% solutions in chlorobenzene, of less than about 10;
- (v) a melt flow index in the Melt Flow Index Test of at least about 20g/10min; and/or
- (vi) a GPC weight average molecular weight in the range of about 8000 to about 20,000.

21. A fiber or filament according to Claim 20 wherein said polybrominated anionic styrenic polymer is a brominated anionic polystyrene.

22. A fiber or filament according to Claim 20 wherein said fiber-forming thermoplastic polymer is a polyester, and wherein said polyester is polyethylene terephthalate, polybutylene terephthalate, or polytrimethylene terephthalate.

23. A fiber or filament according to Claim 22 wherein said bromine content of said polybrominated anionic styrenic polymer is at least about 60 wt%, and wherein said polybrominated anionic styrenic polymer is a brominated anionic polystyrene.

24. A fiber or filament according to Claim 20 wherein said fiber-forming thermoplastic polymer is a polyamide, and wherein said polyamide is nylon-6 (polycaprolactam), nylon-6,6, nylon-6,12, nylon-12 (polylauryllactam), or a high temperature nylon.

25. A fiber or filament according to Claim 24 wherein said bromine content of said polybrominated anionic styrenic polymer is at least about 60 wt%, and wherein said polybrominated anionic styrenic polymer is a brominated anionic polystyrene.

26. A fiber or filament according to Claim 20 wherein said fiber-forming thermoplastic polymer is a polyolefin, and wherein said polyolefin is polypropylene.

27. A fiber or filament according to Claim 26 wherein said bromine content of said polybrominated anionic styrenic polymer is at least about 60 wt%, and wherein said polybrominated anionic styrenic polymer is a brominated anionic polystyrene.

28. A fiber or filament according to Claim 1 wherein said polybrominated anionic styrenic polymer is produced by bromination of an anionic styrenic polymer, which anionic styrenic polymer is produced by a batch process, which process comprises charging a liquid

saturated hydrocarbon diluent and an ether promoter into a reactor; and then

- A) (i) charging a saturated hydrocarbon solution of organolithium initiator into the reactor, in an amount to provide in the range of about 1 to about 10 mol% of organolithium initiator based on the total amount of a styrenic monomer to be added followed by (ii) the controlled addition of the styrenic monomer such that the temperature of the resultant reaction mixture is maintained at or below about 55°C,

or

- B) concurrently feeding separate feeds of (i) a styrenic monomer and (ii) a saturated hydrocarbon solution of organolithium initiator into the reactor, the feeds being maintained at rates to provide for the addition of an amount of organolithium initiator in the range of about 1 to about 10 mol% based on the total amount of styrenic monomer to be added, the temperature of the resultant reaction mixture being maintained at or below about 55°C and feed (ii) being of a shorter duration than feed (i).

29. A fiber or filament according to Claim 28 wherein said polybrominated anionic styrenic polymer is a brominated anionic polystyrene.

30. A fiber or filament according to Claim 28 wherein said fiber-forming thermoplastic polymer is a polyester, and wherein said polyester is polyethylene terephthalate, polybutylene terephthalate, or polytrimethylene terephthalate.

31. A fiber or filament according to Claim 30 wherein said bromine content of said polybrominated anionic styrenic polymer is at least about 60 wt%, and wherein said polybrominated anionic styrenic polymer is a brominated anionic polystyrene.

32. A fiber or filament according to Claim 28 wherein said fiber-forming thermoplastic polymer is a polyamide, and wherein said polyamide is nylon-6 (polycaprolactam), nylon-6,6, nylon-6,12, nylon-12 (polylauryllactam), or a high temperature nylon.

33. A fiber or filament according to Claim 32 wherein said bromine content of said polybrominated anionic styrenic polymer is at least about 60 wt%, and wherein said polybrominated anionic styrenic polymer is a brominated anionic polystyrene.

34. A fiber or filament according to Claim 28 wherein said fiber-forming thermoplastic polymer is a polyolefin, and wherein said polyolefin is polypropylene.

35. A fiber or filament according to Claim 34 wherein said bromine content of said polybrominated anionic styrenic polymer is at least about 60 wt%, and wherein said polybrominated anionic styrenic polymer is a brominated anionic polystyrene.

36. A masterbatch which comprises (a) at least one fiber-forming thermoplastic polymer, and (b) at least one polybrominated anionic styrenic polymer, wherein the polybrominated anionic styrenic polymer has a bromine content of at least about 50 wt%, wherein said polybrominated anionic styrenic polymer is at least about 70 wt% of said masterbatch.

37. A process for producing a fiber or filament, which process comprises melt spinning (a) at least one fiber-forming thermoplastic polymer, and (b) at least one polybrominated anionic styrenic polymer, wherein the polybrominated anionic styrenic polymer has a bromine content of at least about 50 wt%.

38. A process according to Claim 37 wherein said thermoplastic fiber-forming polymer and said polybrominated anionic styrenic polymer are simultaneously mixed and melted.

39. A process according to Claim 37 wherein said fiber-forming thermoplastic polymer is a polyester.

40. A process according to Claim 39 wherein said polyester is polyethylene terephthalate, polybutylene terephthalate, or polytrimethylene terephthalate.

41. A process according to Claim 37 wherein said fiber-forming thermoplastic polymer is a polyamide.

42. A process according to Claim 41 wherein said polyamide is nylon-6 (polycaprolactam), nylon-6,6, nylon-6,12, nylon-12 (polylauryllactam), or a high temperature nylon.

43. A process according to Claim 37 wherein said fiber-forming thermoplastic polymer is a polyolefin.

44. A process according to Claim 43 wherein said polyolefin is polypropylene.

45. A process according to Claim 37 wherein said bromine content of said polybrominated anionic styrenic polymer is at least about 60 wt%.

46. A process according to Claim 37 wherein said polybrominated anionic styrenic polymer is a brominated anionic polystyrene.

47. A process according to Claim 39 wherein said bromine content of said polybrominated anionic styrenic polymer is at least about 60 wt%, wherein said polybrominated anionic styrenic polymer is a brominated anionic polystyrene, and wherein said polyester is polyethylene terephthalate, polybutylene terephthalate, or polytrimethylene terephthalate

48. A process according to Claim 41 wherein said bromine content of said polybrominated anionic styrenic polymer is at least about 60 wt%, wherein said polybrominated anionic styrenic polymer is a brominated anionic polystyrene, and wherein

said polyamide is nylon-6 (polycaprolactam), nylon-6,6, nylon-6,12, nylon-12 (polylauryllactam), or a high temperature nylon.

49. A process according to Claim 44 wherein said bromine content of said polybrominated anionic styrenic polymer is at least about 60 wt%, wherein said polybrominated anionic styrenic polymer is a brominated anionic polystyrene, and wherein said polyolefin is polypropylene.

50. A process according to Claim 37 wherein the linear density of the produced fiber or filament is in the range of about 2 to about 25 denier.

51. A process according to Claim 37 wherein said polybrominated anionic styrenic polymer is brominated anionic polystyrene, and wherein the linear density of the produced fiber or filament is in the range of about 2 to about 25 denier.

52. A process according to Claim 37 wherein said polybrominated anionic styrenic polymer is a component of a masterbatch.

53. A process according to Claim 37 wherein said polybrominated anionic styrenic polymer has at least one of the following characteristics:

- (i) a thermal stability in the Thermal Stability Test of 200 ppm HBr or less;
- (ii) a chlorine content, if any, of less than about 700 ppm Cl;
- (iii) a TGA temperature for 1% weight loss which is 340°C or higher;
- (iv) a ΔE color value, measured using 10 wt% solutions in chlorobenzene, of less than about 10;
- (v) a melt flow index in the Melt Flow Index Test of at least about 20g/10min; and/or
- (vi) a GPC weight average molecular weight in the range of about 8000 to about 20,000.

54. A process according to Claim 53 wherein said polybrominated anionic styrenic polymer is a brominated anionic polystyrene.

55. A process according to Claim 53 wherein said fiber-forming thermoplastic polymer is a polyester, and wherein said polyester is polyethylene terephthalate, polybutylene terephthalate, or polytrimethylene terephthalate.

56. A process according to Claim 55 wherein said bromine content of said polybrominated anionic styrenic polymer is at least about 60 wt%, and wherein said polybrominated anionic styrenic polymer is a brominated anionic polystyrene.

57. A process according to Claim 53 wherein said fiber-forming thermoplastic polymer is a polyamide, and wherein said polyamide is nylon-6 (polycaprolactam), nylon-6,6, nylon-6,12, nylon-12 (polylauryllactam), or a high temperature nylon.

58. A process according to Claim 57 wherein said bromine content of said polybrominated anionic styrenic polymer is at least about 60 wt%, and wherein said polybrominated anionic styrenic polymer is a brominated anionic polystyrene.

59. A process according to Claim 53 wherein said fiber-forming thermoplastic polymer is a polyolefin, and wherein said polyolefin is polypropylene.

60. A process according to Claim 59 wherein said bromine content of said polybrominated anionic styrenic polymer is at least about 60 wt%, and wherein said polybrominated anionic styrenic polymer is a brominated anionic polystyrene.

61. A process according to Claim 37 wherein said polybrominated anionic styrenic polymer is produced by bromination of an anionic styrenic polymer, which anionic styrenic polymer is produced by a batch process, which process comprises charging a liquid saturated hydrocarbon diluent and an ether promoter into a reactor; and then

- A) (i) charging a saturated hydrocarbon solution of organolithium initiator into the reactor, in an amount to provide in the range of about 1 to about 10 mol% of organolithium initiator based on the total amount of a styrenic monomer to be added

followed by (ii) the controlled addition of the styrenic monomer such that the temperature of the resultant reaction mixture is maintained at or below about 55°C,

or

- B) concurrently feeding separate feeds of (i) a styrenic monomer and (ii) a saturated hydrocarbon solution of organolithium initiator into the reactor, the feeds being maintained at rates to provide for the addition of an amount of organolithium initiator in the range of about 1 to about 10 mol% based on the total amount of styrenic monomer to be added, the temperature of the resultant reaction mixture being maintained at or below about 55°C and feed (ii) being of a shorter duration than feed (i).

62. A process according to Claim 61 wherein said polybrominated anionic styrenic polymer is a brominated anionic polystyrene.

63. A process according to Claim 61 wherein said fiber-forming thermoplastic polymer is a polyester, and wherein said polyester is polyethylene terephthalate, polybutylene terephthalate, or polytrimethylene terephthalate.

64. A process according to Claim 63 wherein said bromine content of said polybrominated anionic styrenic polymer is at least about 60 wt%, and wherein said polybrominated anionic styrenic polymer is a brominated anionic polystyrene.

65. A process according to Claim 61 wherein said fiber-forming thermoplastic polymer is a polyamide, and wherein said polyamide is nylon-6 (polycaprolactam), nylon-6,6, nylon-6,12, nylon-12 (polylauryllactam), or a high temperature nylon.

66. A process according to Claim 65 wherein said bromine content of said polybrominated anionic styrenic polymer is at least about 60 wt%, and wherein said polybrominated anionic styrenic polymer is a brominated anionic polystyrene.

67. A process according to Claim 61 wherein said fiber-forming thermoplastic polymer is a polyolefin, and wherein said polyolefin is polypropylene.

68. A process according to Claim 67 wherein said bromine content of said polybrominated anionic styrenic polymer is at least about 60 wt%, and wherein said polybrominated anionic styrenic polymer is a brominated anionic polystyrene.

69. A composition which is a carrier blend, which blend is formed from ingredients comprising (i) at least one polybrominated anionic styrenic polymer, wherein the polybrominated anionic styrenic polymer has a bromine content of at least about 50 wt%, and (ii) at least one synergist or at least one other flame retardant.

70. A composition according to Claim 69 wherein said bromine content of said polybrominated anionic styrenic polymer is at least about 60 wt%, and wherein said polybrominated anionic styrenic polymer is a brominated anionic polystyrene.

71. A process for forming a carrier blend, which process comprises mixing and melting together (i) at least one polybrominated anionic styrenic polymer, wherein the polybrominated anionic styrenic polymer has a bromine content of at least about 50 wt%, and (ii) at least one synergist or at least one other flame retardant.

72. A process according to Claim 71 wherein said bromine content of said polybrominated anionic styrenic polymer is at least about 60 wt%, and wherein said polybrominated anionic styrenic polymer is a brominated anionic polystyrene.

73. A process for producing a fiber or filament, which process comprises melt spinning (a) at least one fiber-forming thermoplastic polymer, and (b) a carrier blend of Claim 69.

74. A process according to Claim 73 wherein said bromine content of said

polybrominated anionic styrenic polymer is at least about 60 wt%, and wherein said polybrominated anionic styrenic polymer is a brominated anionic polystyrene.

75. A process according to Claim 71 which further comprises melt spinning said carrier blend together with at least one fiber-forming thermoplastic polymer to form a fiber or filament.

76. A process according to Claim 75 wherein said bromine content of said polybrominated anionic styrenic polymer is at least about 60 wt%, and wherein said polybrominated anionic styrenic polymer is a brominated anionic polystyrene.

77. A carrier blend according to Claim 69 wherein said polybrominated anionic styrenic polymer has at least one of the following characteristics:

- (i) a thermal stability in the Thermal Stability Test of 200 ppm HBr or less;
- (ii) a chlorine content, if any, of less than about 700 ppm Cl;
- (iii) a TGA temperature for 1% weight loss which is 340°C or higher;
- (iv) a ΔE color value, measured using 10 wt% solutions in chlorobenzene, of less than about 10;
- (v) a melt flow index in the Melt Flow Index Test of at least about 20g/10min; and/or
- (vi) a GPC weight average molecular weight in the range of about 8000 to about 20,000.

78. A process according to Claim 71 wherein said polybrominated anionic styrenic polymer has at least one of the following characteristics:

- (i) a thermal stability in the Thermal Stability Test of 200 ppm HBr or less;
- (ii) a chlorine content, if any, of less than about 700 ppm Cl;
- (iii) a TGA temperature for 1% weight loss which is 340°C or higher;
- (iv) a ΔE color value, measured using 10 wt% solutions in chlorobenzene, of less than about 10;
- (v) a melt flow index in the Melt Flow Index Test of at least about 20g/10min; and/or
- (vi) a GPC weight average molecular weight in the range of about 8000 to about 20,000.